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Learning Science in the Wild: Conversational Interactions during Biology Fieldwork

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Over the past few years, there has been a growing interest in investigating scientific reasoning and practices in authentic, real-life scientific contexts (*in vivo* studies, in Dunbar's terminology). Considerable effort has been devoted to studying distributed reasoning (Dunbar, 1995) and the use of artifacts, representations, and models within lab settings (Schunn, Saner, Kirschenbaum, Trafton, & Littleton, in press). However, only recently has research begun to underscore scientific settings, particularly university labs, as learning environments where the trajectories of participation of young scientists can be traced (Kurz-Milcke, Nersessian, & Newstetter, 2004). The study reported here investigated the interactions between experts and apprentices in the context of joint scientific practices during biology fieldwork, a setting not previously explored and yet of paramount importance for the biological sciences. The study focused on the experts' actions and conversational contributions with an emphasis on how they may support student learning.

In addition to serving the purpose of data collection, fieldwork is a scenario where critical epistemic practices in biology are socialized, and one that draws intense personal feelings in professional biologists. Fieldwork is both a valued scientific activity and an informal learning environment, usually nested within formal academic programs in the biological sciences. Like many lab settings, fieldwork routinely includes the participation of experts, graduate research assistants, and students in complex patterns of interaction. Thus, the study of fieldwork in biology may shed light on how science is done and how apprentices become scientists in the very making of science.

Method

Data were collected during fieldtrips conducted in the context of two undergraduate courses in a large research university in Colombia: (a) a first-year course in organismic biology; and (b) an advanced course in marine ecology. The first fieldtrip consisted of a two-day visit to a paramo ecosystem in the Colombian Andes. Students underwent preliminary training in conducting inventories of biodiversity. The second fieldtrip consisted of a five-day visit to a tidal coastal ecosystem in the Caribbean Sea, where biology majors conducted research on mangroves. In both fieldtrips, participants were a faculty member expert in the particular ecosystem, a team of graduate research assistants, and 30 undergraduate students. Data collection procedures included ethnographic field notes, video of group activities, on-site interviews, and wireless audio recording of the faculty members' conversational exchanges with students in the context of joint activities. Audio recordings were coded using the ATLAS.ti™ software for qualitative analysis. Analyses of category frequencies, interaction patterns, and activity structures were conducted and complemented with ethnographic field notes and content analysis of on-site interviews.

Results

Results suggest that experts played three distinctive roles in their joint practices during fieldwork. First, they set forth *socio-scientific norms*, that is, norms, values, and attitudes, either disciplinary or personal, about how to engage in or cope with routine activities during fieldwork (e.g., adaptation to atypical conditions, personal safety, aesthetic appreciation, exploration and reconnaissance, data collection). Second, experts modeled *disciplinary practices* for apprentices: taxonomic classification, specimen naming, disciplinary explanation, and artifact use (e.g., quadrants, transects). Finally, experts provided students *cognitive scaffolding* by focusing the students' attention on particular features, drawing analogies, and asking critical questions. Particularly salient were the experts' attempts to accommodate and simplify the open-endedness and complexity of natural environments to research goals and observational protocols. Category frequencies and analyses of participation patterns within activity settings showed how joint practices and conversational interactions both support knowledge acquisition and provide bearings that guide the emergence of the disciplinary identities of young biologists.

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